









Europa: Ingredients for Life?

- Water: *More than 2x all of Earth's oceans*
- Essential elements: *From formation and impacts*
- Chemical energy: *Potentially from above and below*
- Stability: *Variable, but "simmering" for 4 billion years*

"Black smoker" on Earth's ocean floor
Woods Hole Oceanographic Institution

Understanding Europa's Habitability: Key Issues

- Ocean:** Existence, extent, and salinity
- Ice Shell:** Existence and nature of water within or beneath, and nature of surface-ice-ocean exchange
- Composition:** Distribution and chemistry of key compounds and the links to ocean composition
- Geology:** Characteristics and formation of surface features, including sites of recent or current activity

Looking Forward: Europa Clipper

Science:

Objective	Clipper	Enhanced w Recon
Ocean	✓	✓
Ice Shell	✓	✓
Composition	✓	✓
Geology	✓	✓
Recon	✓	✓

Payload:

Instrument	Clipper	Enh w Recon
Floor	IPR	SWIRS
	TI	
Baseline	NMS	Shortwave Infrared Spectrometer (SWIRS)
	MAG	LP
	GS	Ice Penetrating Radar (IPR)
	Recon	
	Thermal	

Operations Concept:

- 32 low altitude flybys of Europa from Jupiter orbit over 2.3 years
- Detailed investigation of globally distributed regions of Europa
- Simple repetitive science operations
- Landing site reconnaissance capability

Technical Margins

	39%	40%	75%
Mass			
Power			
Data			

Cost: \$2.0B
\$FY15, Phases A-E Excl LV

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